Geotechnical Engineering Investigation

Boeing Business Center Building A & B
Francisco Avenue and Western Avenue
Los Angeles, California

Prepared For:

PRES
18301 Von Karman, Suite 490
Irvine, California 92612

Attn: Mr. Glen Allen

Project Number 8095-99
May 12, 1999

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NorCal Engineering

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May 12, 1999 Project Number 8095-99

PRES
18301 Von Karman, Suite 490
Irvine, California 92612

Attn: Mr. Glen Allen

RE: **GEOTECHNICAL ENGINEERING INVESTIGATION** - Proposed Office/Warehouse Development - Located South of Francisco Avenue and East of Western Avenue, in the City of Los Angeles, California

Dear Mr. Allen:

Pursuant to your request, this firm has performed a Geotechnical Engineering Investigation for the above referenced project in accordance to our signed proposal dated April 23, 1999. The purpose of this investigation is to evaluate the subsurface conditions of the subject site and to provide recommendations for the proposed office development.

The scope of work included the following: 1) site reconnaissance; 2) subsurface geotechnical exploration and sampling; 3) laboratory testing; 4) engineering analysis of field and laboratory data; 5) preparation of a geotechnical engineering report. It is the opinion of this firm that the proposed development is feasible from a geotechnical standpoint provided that the recommendations presented in this report are followed in the design and construction of the project.

1.0 Project Description

Presently the rough grading for this project is underway and is being inspected and tested by this firm. The building areas have been graded to achieve proper drainage and will be later fine graded to construct proposed building pads.

At this time, no grading plan has been made available for this firm to review. However, it is proposed to construct an office warehouse development on the approximately 18 acre parcel. Two buildings consisting of 247,574 square feet and 252,663 square feet will be constructed on this property. Other improvements will probably consist of concrete and/or asphaltic pavement and landscaping. It is assumed that the proposed grading for the development will include minor cut and fill procedures.

Final building plans shall be reviewed by this firm prior to submittal for city approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary.

2.0 Site Description

The generally square shaped parcel is located south of Francisco Avenue and east of Western Avenue, in the City of Los Angeles. The topography of the relatively level property descends slightly from south to north and is currently undeveloped land. A low area is located in the central portion of Building A which is an abandoned sewer line. The assessment of the backfill of this sewer line is part of this investigation.

3.0 Site Exploration

The investigation consisted of the placement of ten (10) subsurface exploratory boring by a truck mounted drill rig with eight inch outside diameter hollow-stem, continuous flight augers and five (5) trenches by a backhoe to a maximum depth of 18 feet below current ground elevations. The explorations were visually classified and logged by a field engineer with locations of the subsurface explorations shown on the attached Site Plan.

The exploratory borings revealed the existing earth materials to consist of a fill and natural soil. A detailed description of the subsurface conditions are listed on the excavation logs in Appendix A. It should be noted that the transition from one soil type to another as shown on the boring logs is approximate and may in fact be a gradual transition. The soils encountered are described as follows:

Uncompacted Fill: A fill soil classifying as brown, sandy CLAY and silty CLAY was encountered in Test Excavation 1 to a depth of 14 feet. The underground utility line was encountered at this depth. These soils were noted to be soft to medium stiff and moist to very moist.

Compacted Fill: Compacted fill soils consisting of sandy silty and sandy CLAY were encountered in the remainder of the excavations to depths ranging between 3 to 10 feet. Occasional small pieces of hand fill such as gravel, rock and concrete were encountered. These fill soils were very dense and moist.

Natural: An undisturbed alluvium soil classifying as a silty CLAY with sand was encountered beneath the upper surface soils. These native soils were observed to be stiff and moist.

Groundwater was not encountered. In addition, no caving occurred to the depth of our excavations.

4.0 Laboratory Tests

Relatively undisturbed samples of the subsurface soils were obtained to perform laboratory testing and analysis for direct shear, consolidation tests, and to determine in-place moisture/densities. These relatively undisturbed ring samples were obtained by driving a thin-walled steel sampler lined with one inch long brass rings with an inside diameter of 2.42 inches into the undisturbed soils. The sampler was driven a total of twelve inches with blow counts taken in six inch increments.

Standard penetration tests were obtained by driving a steel sampler lined with six inch long brass rings with an inside diameter of 1.5 inches into the soils. This standard penetrometer sampler was driven a total of eighteen inches with blow counts tallied every six inches. Blow count data is given on the Borings Logs in Appendix A.

Bulk bag samples were obtained in the upper soils for expansion index tests and maximum density tests. Wall loadings on the order of 4,000 lbs./lin.ft. and maximum compression loads on the order of 100 kips were utilized for testing and design purposes. All test results are included in Appendix B, unless otherwise noted.

4.1 **Field moisture content** (ASTM:D 2216) and the dry density of the ring samples were determined in the laboratory. This data is listed on the logs of explorations.

4.2 **Maximum density tests** (ASTM: D-1557-91) were performed on typical samples of the upper soils. Results of these tests are shown on Table I.

4.3 **Expansion index tests** in accordance with the Uniform Building Code Standard No. 29-2 were performed on remolded samples of the upper soils to determine the expansive characteristics and to provide any necessary recommendations for reinforcement of the slabs-on-grade and the foundations. Results of these tests are provided on Table II.

4.4 **Corrosion tests** consisting of sulfate, pH, resistivity and chloride analysis to determine potential corrosive effects of soils on concrete and underground utilities are being performed in the laboratory. Test results will be provided in an addendum report.

4.5 **Direct shear tests** (ASTM: D-3080) were performed on undisturbed and disturbed samples of the subsurface soils. These tests were performed to determine parameters for the calculation of the safe bearing capacity. The test is performed under saturated conditions at loads of 500 lbs./sq.ft., 1,000 lbs./sq.ft., and 2,000 lbs./sq.ft. with results shown on Plate A.

4.6 **Consolidation tests** (ASTM: D-2435) were performed on undisturbed samples to determine the differential and total settlement which may be anticipated based upon the proposed loads. Water was added to the samples at a surcharge of one KSF and the settlement curves are plotted on Plate B.

4.7 **R-Value test** (California Test Method 301) was performed on a representative soils sample which may be anticipated to be near subgrade to determine pavement design.

5.0 Seismicity Evaluation

There are no known active or potentially active faults trending toward or through the site. The proposed development lies outside of any Alquist Priolo Special Studies Zone and the potential damage due to direct fault rupture is considered very remote. The site is located in an area of high regional seismicity and a maximum credible horizontal ground acceleration of 0.47g may occur from a Magnitude 7.0 earthquake along the Palos Verdes fault zone, which is located approximately 5 miles away. Ground shaking originating from earthquakes along other active faults in the region is expected to induce lower horizontal accelerations due to smaller anticipated earthquakes and/or greater distances to other faults. The following table provides information on nearby major active faults along with peak horizontal ground accelerations.

Estimated Maximum Probable Ground Motion Parameters

Fault Zone	Approximate Distance From Site (Miles)	Maximum Probable Magnitude (Richter)	Peak Horizontal Acceleration (g)
Newport-Inglewood	4 NE	6.9	0.45
Palos Verdes	5 SW	7.1	0.47
Whittier	18 NE	6.8	0.23
San Andreas	49 NE	8.2	0.17

CDMG Open File Reports 92-03 and 96-08

The following earthquake design parameters are based upon the 1997 Uniform Building Code (UBC) for a Seismic Zone 4 with a Z factor of 0.40 and a Soil Profile Type of S_D, a stiff soil profile.

Earthquake Fault	Newport-Inglewood	Palos Verdes
1. Distance to Fault	6 km	8 km
2. Seismic Source Type	B	B
3. Seismic Coefficient = C*a*	(0.44) Na	(0.44) Na
4. Seismic Coefficient = C*v*	(0.64) Nv	(0.64) Nv
5. Near-Source Factor N*a*	1.0	1.0
6. Near-Source Factor N*v*	1.2	1.2

6.0 Liquefaction Evaluation

The site is expected to experience ground shaking and earthquake activity that is typical of Southern California area. It is during severe ground shaking that loose, granular soils below the groundwater table can liquefy. A review of the exploratory excavations and the fine grained soils encountered and groundwater level of in excess of 50 feet reveals the liquefaction potential to be very low in this vicinity.

7.0 Groundwater Study

Regionally, the groundwater profile in the vicinity of the site consists of a deep aquifer in excess of 50 feet below ground surface based upon groundwater maps of the area. Groundwater was not encountered during our field exploration. Local fluctuations of perched groundwater have been associated with mounding due to localized irrigation and rainwater infiltration onto laterally discontinuous and relatively impermeable clay layers. At this time, the underlying groundwater shall not impose an adverse condition to the planned development.

8.0 Conclusions and Recommendations

Based upon our evaluations, the proposed development is acceptable from a geotechnical engineering standpoint. By following the recommendations and guidelines set forth in our report, the structures will be safe from excessive settlements under the anticipated design loadings and conditions. The proposed development shall meet all requirements of the City Building Ordinance and will not impose any adverse effect on existing adjacent structures.

The following recommendations are based upon geotechnical conditions encountered in our field investigation and laboratory data. Therefore, these surface and subsurface conditions could vary across the site. Variations in these conditions may not become evident until the commencement of grading operations and any unusual conditions which may be encountered in the course of the project development may require the need for additional study and revised recommendations.

It is recommended that site inspections be performed by a representative of this firm during all grading and construction of the development to verify the findings and recommendations documented in this report. The following sections present a discussion of geotechnical related requirements for specific design recommendations of different aspects of the project.

8.1 Site Grading Recommendations

Any vegetation shall be removed and hauled from proposed grading areas prior to the start of grading operations. Existing vegetation shall not be mixed or disced into the soils. Any removed soils may be reutilized as compacted fill once any deleterious material or oversized materials (in excess of eight inches) is removed. Grading operations shall be performed in accordance with the attached "Specifications for Compacted Fill Operations".

8.1.1 Removal and Recompaction Recommendations

All upper fill soils shall be scarified to a depth of 12 inches, brought to within 2% of optimum moisture content and compacted to a minimum of 90% of the laboratory standard (ASTM: D-1557-91) prior to placement of any additional compacted fill soils, foundations, slabs-on-grade and pavement. Grading shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

Any imported fill material should preferably be soil similar to the upper soils encountered at the subject site. All soils shall be approved by this firm prior to importing at the site and will be subjected to additional laboratory testing to assure concurrence with the recommendations stated in this report.

Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase. Adequate drainage away from the structures, pavement and slopes should be provided at all times.

If placement of slabs-on-grade and pavement is not completed immediately upon completion of grading operations, additional testing and grading of the areas may be necessary prior to continuation of construction operations. Likewise, if adverse weather conditions occur which may damage the subgrade soils, additional assessment by the geotechnical engineer as to the suitability of the supporting soils may be needed.

8.1.2 **Fill Blanket Recommendations**

Due to the potential for differential settlement of foundations and slab areas placed on compacted fill and native materials, it is recommended that all foundations and slabs be underlain by a uniform compacted fill blanket at least three feet in thickness. This fill blanket shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater. This compacted fill blanket has probably already been performed over a majority of the site during recent grading operations.

8.2 **Shrinkage and Subsidence**

Results of our in-place density tests reveal that the soil shrinkage will be on the order of 15% due to excavation and recompaction, based upon the assumption that the fill is compacted to 92% of the maximum dry density per ASTM standards. Subsidence should be 0.1 feet due to earthwork operations. The shrinkage and subsidence estimated are outside of the loose trench backfills.

The volume change does not include any allowance for vegetation or organic stripping, removal of subsurface improvements or topographic approximations. Although these values are only approximate, they represent our best estimate of lost yardage which will likely occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field testing using the actual equipment and grading techniques should be conducted.

8.3 Temporary Excavations

Temporary unsurcharged excavations in the existing site materials less than 3 feet high may be made at a vertical gradient unless cohesionless soils are encountered. Temporary unsurcharged excavations from 4 to 8 feet high may be trimmed at a 1 to 1 (horizontal to vertical) gradient. In areas where soils with little or no binder are encountered, where adverse geological conditions are exposed, or where excavations are adjacent to existing structures, shoring, slot-cutting, or flatter excavations may be required. The temporary cut slope gradients given do not preclude local raveling and sloughing. All excavations shall be made in accordance with the requirements of CAL-OSHA and other public agencies having jurisdiction. Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase.

8.4 Foundation Design

All foundation may be designed utilizing the following safe bearing capacities for an embedded depth of 24 inches into dense compacted fill materials with the corresponding widths:

Allowable Safe Bearing Capacity (psf)

Width (ft)	Continuous Foundation	Isolated Foundation
1.5	2000	2500
2.0	2050	2550
4.0	2250	2750
6.0	2450	2950

The bearing value may be increase by 500 psf for each additional foot of depth in excess of the 24 inch minimum depth, up to a maximum of 4,000 psf. A one third increase may be used when considering short term loading and seismic forces. A substantial decrease in the above bearing capacities will be necessary if the required compacted fill blanket is not provided beneath and outside of foundations. Any foundations located along the property lines where lateral overexcavation is not possible may utilize a safe bearing capacity of 1,250 psf.

All continuous foundations shall be reinforced with a minimum of one #5 bar, top and bottom; isolated pad foundations reinforced at the discretion of the project structural engineer. A representative of this firm shall inspect all foundation excavations prior to pouring concrete.

8.5 **Settlement Analysis**

Resultant pressure curves for the consolidation tests are shown on Plate B. Computations utilizing these curves and the recommended safe bearing capacities reveal that the foundations will experience settlements on the order of 3/4 inch and differential settlements of less than 1/4 inch.

8.6 **Lateral Resistance**

The following values may be utilized in resisting lateral loads imposed on the structure. Requirements of the Uniform Building Code should be adhered to when the coefficient of friction and passive pressures are combined.

Coefficient of Friction - 0.35

Equivalent Passive Fluid Pressure = 200 lbs./cu.ft.

Maximum Passive Pressure = 2,000 lbs./cu.ft.

The passive pressure recommendations are valid only for approved compacted fill soils.

8.7 **Retaining Wall Design Parameters**

Active earth pressures against retaining walls will be equal to the pressures developed by the following fluid densities. These values are for **granular backfill material** placed behind the walls at various ground slopes above the walls.

Surface Slope of Retained Materials (Horizontal to Vertical)	Equivalent Fluid Density (lb./cu.ft.)
Level	30
5 to 1	35
4 to 1	38
3 to 1	40
2 to 1	45

Any applicable short-term construction surcharges and seismic forces should be added to the above lateral pressure values. A backfill zone of non-expansive material shall consist of a wedge beginning a minimum of one horizontal foot from the base of the wall extending upward at an inclination no less than 1/4 to 1 (horizontal to vertical). All walls shall be waterproofed as needed and protected from hydrostatic pressure by a reliable permanent subdrain system.

8.8 **Slab Design**

All concrete slabs-on-grade shall be at least five inches in thickness, and shall be reinforced with a minimum of No. 3 bars, eighteen inches in each direction positioned mid-height in the slab. Reinforcement requirements and an increase in thickness of the slabs-on-grade may be necessary based upon proposed loading conditions in the structures. A vapor barrier sandwiched between a four inch thick sand layer should be utilized in areas which would be sensitive to the infiltration of moisture. The subgrade soils shall be moistened to 130% of optimum moisture content immediately prior to pouring of concrete. All concrete slab areas to receive floor coverings should be moisture tested to meet all manufacturer requirements prior to placement.

8.9 **Pavement Section Design**

The table below provides a preliminary pavement design based upon an R-Value of 23 for the proposed pavement areas. Final pavement design may need to be based on R-Value testing of the subgrade soils near the conclusion of rough grading to assure that these soils are consistent with those assumed in this preliminary design.

Type of Traffic	Traffic Index	Asphaltic Concrete (in)	Base Material (in)
Parking Stalls	4.0	3.0	4.5
Light Vehicle Circulation Areas	5.0	3.5	7.5
Medium Truck Access Areas (GVW < 42,000 lbs.; 3 axle)	6.0	4.0	9.5

All concrete slabs to be utilized for pavement shall be a minimum of six inches in thickness and placed on approved subgrade soils. Final pavement section designs for pavement areas may need to be determined by additional testing of the subgrade near the conclusion of grading operations. In addition, the above recommendations are based upon estimated traffic loads. Client should submit anticipated traffic loadings when available, so that pavement sections may be reviewed to determine adequacy to support the proposed loadings.

Any approved base material shall consist of a Class II aggregate or equivalent and should be compacted to a minimum of 95% relative compaction. All pavement materials shall conform to the requirements set forth by the City of Los Angeles. The base material and asphaltic concrete should be tested prior to delivery to the site and during placement to determine conformance with the project specifications. A pavement engineer shall designate the specific asphalt mix design to meet the required project specifications.

8.10 **Utility Trench and Excavation Backfill**

Trenches from installation of utility lines and other excavations may be backfilled with on-site soils or approved imported soils compacted to a minimum of 90% relative compaction. All utility lines shall be properly bedded with clean sand having a sand equivalency rating of 30 or more. This bedding material shall be thoroughly water jetted around the pipe structure prior to placement of compacted backfill soils.

9.0 Closure

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. It is the responsibility of the owner to ensure that all information within this report is submitted to the Architect and appropriate Engineers for the project.

This firm should have the opportunity to review the final plans to verify that all our recommendations are incorporated. This report and all conclusions are subject to the review of the controlling authorities for the project.

A preconstruction conference should be held between the developer, general contractor, grading contractor, city inspector, architect, and soil engineer to clarify any questions relating to the grading operations and subsequent construction. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D. Tucker
Project Engineer
R.G.E. 841

REGISTERED PROFESSIONAL ENGINEER
KEITH D. TUCKER
No. 841
Exp. 12/31/00
GEOTECHNICAL
STATE OF CALIFORNIA

Troy D. Norrell
President

SPECIFICATIONS FOR PLACEMENT OF COMPACTED FILL

Excavation

Any existing low density soils and/or saturated soils shall be removed to competent natural soil under the inspection of the Soils Engineering Firm. After the exposed surface has been cleansed of debris and/or vegetation, it shall be scarified until it is uniform in consistency, brought to the proper moisture content and compacted to a minimum of 90% relative compaction (in accordance with ASTM: D-1557-78).

In any area where a transition between fill and native soil or between bedrock and soil are encountered, additional excavation beneath foundations and slabs will be necessary in order to provide uniform support and avoid differential settlement of the structure.

Material For Fill

The on-site soils or approved import soils may be utilized for the compacted fill provided they are free of any deleterious materials and shall not contain any rocks, brick, asphaltic concrete, concrete or other hard materials greater than eight inches in maximum dimensions. Any import soil must be approved by the Soils Engineering firm a minimum of 24 hours prior to importation of site.

Placement of Compacted Fill Soils

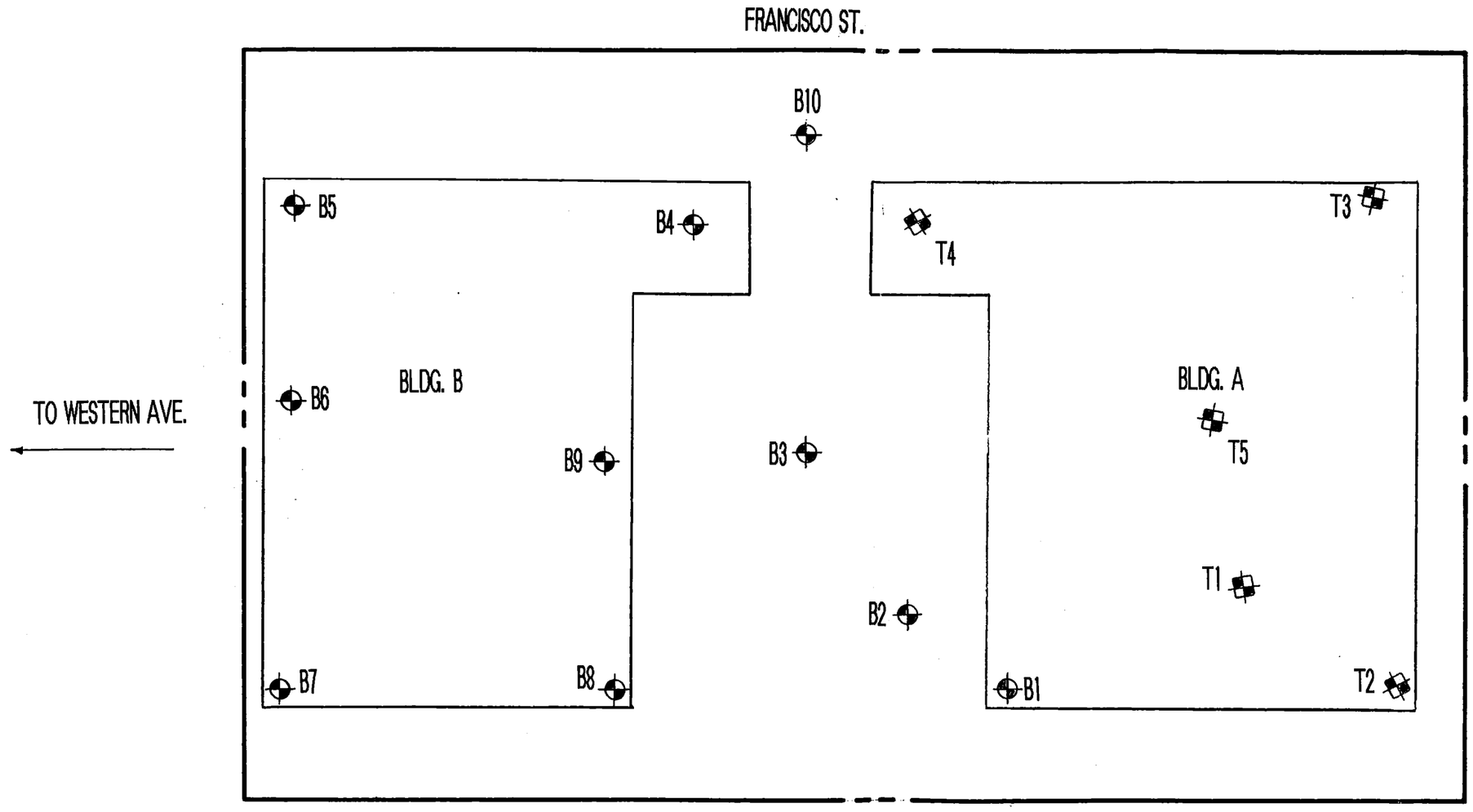
The approved fill soils shall be placed in layers not excess of six inches in thickness. Each lift shall be uniform in thickness and thoroughly blended. The fill soils shall be brought to within 15% of the optimum moisture content, unless otherwise specified by the Soils Engineering firm. Each lift shall be compacted to a minimum of 90% relative compaction (in accordance with ASTM: D-1557-78) and approved prior to the placement of the next layer of soil. Compaction tests shall be obtained at the discretion of the Soils Engineering firm but to a minimum of one test for every 500 cubic yards placed and/or for every 2 feet of compacted fill placed.

The minimum relative compaction shall be obtained in accordance with accepted methods in the construction industry. The final grade of the structural areas shall be in a dense and smooth condition prior to placement of slabs-on-grade or pavement areas. No fill soils shall be placed, spread or compacted during unfavorable weather conditions. When the grading is interrupted by heavy rains, compaction operations shall not be resumed until approved by the Soils Engineering firm.

Grading Observations

The controlling governmental agencies should be notified prior to commencement of any grading operations. This firm recommends that the grading operations be conducted under the observation of a Soils Engineering firm as deemed necessary. A 24 hour notice must be provided to this firm prior to the time of our initial inspection.

Observation shall include the clearing and grubbing operations to assure that all unsuitable materials have been properly removed; approve the exposed subgrade in areas to receive fill and in areas where excavation has resulted in the desired finished grade and designate areas of overexcavation; and perform field compaction tests to determine relative compaction achieved during fill placement. In addition, all foundation excavations shall be observed by the Soils Engineering firm to confirm that appropriate bearing materials are present at the design grades and recommend any modifications to construct footings.



NorCal Engineering SOILS AND GEOTECHNICAL CONSULTANTS	APPROXIMATE LOCATIONS OF TEST EXPLORATIONS
P.R.E.S.	
PROJECT 8095-99 / DATE MAY 1999	

List of Appendices

(in order of appearance)

Appendix A

MAJOR DIVISIONS			SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS LARGER THAN 200 SIEVE SIZE)	GRAVELS (MORE THAN 50% OF COARSE FRACTION IS LARGER THAN THE NO. 4 SIEVE SIZE)	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES.
			GP	POORLY GRADED GRAVELS OR GRAVEL - SAND MIXTURES, LITTLE OR NO FINES.
		GRAVELS WITH FINES (APPRECIABLE AMT. OF FINES)	GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES.
			GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES.
	SANDS (MORE THAN 50% OF COARSE FRACTION IS SMALLER THAN THE NO. 4 SIEVE SIZE)	CLEAN SANDS	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES.
			SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES.
		SANDS WITH FINES (APPRECIABLE AMT. OF FINES)	SM	SILTY SANDS, SAND - SILT MIXTURES.
			SC	CLAYEY SANDS, SAND - CLAY MIXTURES.
FINE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS SMALLER THAN 200 SIEVE SIZE	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY.
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS.
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS
	SILTS AND CLAYS (LIQUID LIMIT MORE THAN 50)		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS.
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS.
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

BOUNDARY CLASSIFICATIONS: SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY COMBINATIONS OF GROUP SYMBOLS.

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

UNIFIED SOIL CLASSIFICATION SYSTEM

PROJECT | DATE

	MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
	14.9	98.7		R/B		FILL SOILS CLAY, sandy and silty CLAY, with SAND, stiff in upper 1.5 feet medium stiff below 1.5 feet, very moist soft at 9.0' pipe at 12'	
	15.6	94.6		R/B	5		
	18.8	93.0		R			
	19.7	88.7		R/B	10		
					15		
					20		
					25		
					30		
					35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 5/5/98
EQUIPMENT USED: Extension Backhoe
GROUNDWATER LEVEL: Not Encountered

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXCAVATION # 1

PROJECT 8095-99 | DATE

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
11.8	116.9		R	0	COMPACTED FILL SOILS Silty CLAY and Sandy CLAY, with occasional gravel, stiff, moist	
13.7	115.6		R	5	NATIVE SOILS CLAY, silty with SAND, light brown, stiff, moist	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- C Rock Core
- S Standard Split Spoon
- R Ring Sample
- B Bulk Sample
- J Jar Sample

DATE DRILLED: 5/5/98
EQUIPMENT USED: Extension Backhoe
GROUNDWATER LEVEL: Not Encountered

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXCAVATION # 2

PROJECT 8095-99 | DATE

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					COMPACTED FILL SOILS Silty CLAY, and Sandy CLAY, with occasional gravel, stiff, moist	
14.1	113.9		R	5	NATIVE SOILS CLAY, silty with sand, light brown, stiff, moist	
15.7	114.8		R	10	CLAY, sandy, light brown, medium stiff, -increase in sand content with depth	
20.9	103.0		R	15	SAND, fine grained, silty, brown, medium dense damp	
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 5/5/98
EQUIPMENT USED: Extension Backhoe
GROUNDWATER LEVEL: Not Encountered

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

LOG OF TEST EXCAVATION # 3

PROJECT 8095-99 | DATE

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
12.8	114.9		R	0	COMPACTED FILL SOILS Silty CLAY, and Sandy CLAY, with occasional gravel, stiff, moist	
				5	NATIVE SOILS CLAY, silty with sand, light brown, stiff, moist	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 5/5/98
EQUIPMENT USED: Extension Backhoe
GROUNDWATER LEVEL: Not Encountered

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LOG OF TEST EXCAVATION # 4

PROJECT 8095-99 | DATE

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					COMPACTED FILL SOILS Silty CLAY and Sandy CLAY, with occasional gravel, stiff, moist	
14.9	112.9		R	5	NATIVE SOILS CLAY, silty with SAND, light brown, stiff, moist	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 5/5/98
EQUIPMENT USED: Extension Backhoe
GROUNDWATER LEVEL: Not Encountered

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LOG OF TEST EXCAVATION # 5

PROJECT 8095-99 | DATE

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					COMPACTED FILL SOILS Silty CLAY and Sandy CLAY with occasional gravel, stiff, moist	
				5	NATIVE SOILS CLAY silty with SAND, light brown, stiff, moist	
15.9	112.6		R		CLAY, sandy, light brown, moist, medium stiff	
18.6	102.1		R	10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 5/5/99
EQUIPMENT USED: Hollow Stem Auger
GROUNDWATER LEVEL: Not Encountered

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PROJECT 8095-99 | DATE

LOG OF BORING #1

	MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
	13.4			B	0	COMPACTED FILL SOILS Silty CLAY and Sandy CLAY with occasional gravel, stiff, moist	
					5		
					10		
					15		
					20		
					25		
					30		
					35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 5/5/99
EQUIPMENT USED: Hollow Stem Auger
GROUNDWATER LEVEL: Not Encountered

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LOG OF BORING # 2

PROJECT 8095-99 | DATE

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					COMPACTED FILL SOILS Silty CLAY and Sandy CLAY with occasional gravel, stiff, moist	
				5		
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- C Rock Core
- S Standard Split Spoon
- R Ring Sample
- B Bulk Sample
- J Jar Sample

DATE DRILLED: 5/5/99
EQUIPMENT USED: Hollow Stem Auger
GROUNDWATER LEVEL: Not Encountered

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PROJECT 8095-99 | DATE

LOG OF BORING # 3

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
13.0	114.0		R		COMPACTED FILL SOILS Silty CLAY and Sandy CLAY with occasional gravel, stiff, moist	
				5	NATIVE SOILS CLAY, silty with SAND, light brown, stiff, moist	
15.6	113.1		R	10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 5/5/99
EQUIPMENT USED: Hollow Stem Auger
GROUNDWATER LEVEL: Not Encountered

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LOG OF BORING # 4

PROJECT 8095-99 | DATE

	MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
	12.9	115.9		R	0	COMPACTED FILL SOILS Silty CLAY and Sandy CLAY with occasional gravel, stiff, moist	
					5	NATIVE SOILS CLAY, silty with SAND, light brown, stiff, moist	
					10		
					15		
					20		
					25		
					30		
					35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 5/5/99
EQUIPMENT USED: Hollow Stem Auger
GROUNDWATER LEVEL: Not Encountered

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LOG OF BORING # 5

PROJECT 8095-99 | DATE

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					COMPACTED FILL SOILS Silty CLAY and Sandy CLAY, with occasional; gravel, stiff, moist	
				5	NATIVE SOILS CLAY silwty with SAND, light brown, stiff, moist	
15.0	112.9		R			
				10		
16.1	111.8		R			
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- C Rock Core
- S Standard Split Spoon
- R Ring Sample
- B Bulk Sample
- J Jar Sample

DATE DRILLED: 5/5/98
EQUIPMENT USED: Hollow Stem AUger
GROUNDWATER LEVEL: Not Encountered

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LOG OF TEST EXCAVATION # 6

PROJECT 8095-99 | DATE

	MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
	13.7	115.7		R	0	COMPACTED FILL SOILS Silty CLAY and Sandy CLAY with occasional gravel, stiff, moist	
					5	NATIVE SOILS CLAY, silty with SAND, light brown, stiff, moist	
	11.8	115.2		R	10		
	13.9	113.6		R	15		
					20		
					25		
					30		
					35		

SAMPLE TYPES

- C Rock Core
- S Standard Split Spoon
- R Ring Sample
- B Bulk Sample
- J Jar Sample

DATE DRILLED: 5/5/99
EQUIPMENT USED: Hollow Stem Auger
GROUNDWATER LEVEL: Not Encountered

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LOG OF BORING # 7

PROJECT 8095-99 | DATE

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
				0	THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
					COMPACTED FILL SOILS Silty CLAY and Sandy CLAY, with occasional gravel, stiff, moist	
				5	NATIVE SOILS CLAY, silty with SAND, light brown, stiff, moist	
14.7	113.6		R	10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 5/5/99
EQUIPMENT USED: Hollow Stem Auger
GROUNDWATER LEVEL: Not Encountered

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LOG OF BORING #8

PROJECT 8095-99 | DATE

	MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
						THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
	12.9	115.9		R/B	0	COMPACTED FILL SOILS Silty CLAY and Sandy CLAY with occasional gravel, stiff, moist	
	13.7	111.5		R	5	NATIVE SOILS CLAY, silty with SAND, light brown, stiff, moist	
	14.1	109.8		R	10		
					15		
					20		
					25		
					30		
					35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 5/5/99
EQUIPMENT USED: Hollow Stem Auger
GROUNDWATER LEVEL: Not Encountered

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PROJECT 8095-99 | DATE

LOG OF BORING #9

MOISTURE (%)	DRY DENSITY (PCF)	PENETRATION RESISTANCE (BLOWS/FOOT)	SAMPLE TYPE	DEPTH (FEET)	DESCRIPTION OF SUBSURFACE MATERIALS	ELEVATION (FEET)
					THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.	
12.6	115.7		R/B	0	COMPACTED FILL SOILS Silty CLAY and Sandy CLAY, with occasional gravel, stiff, moist	
				5	NATIVE SOILS CLAY, silty with SAND, light brown, stiff, moist	
				10		
				15		
				20		
				25		
				30		
				35		

SAMPLE TYPES

- [C] Rock Core
- [S] Standard Split Spoon
- [R] Ring Sample
- [B] Bulk Sample
- [J] Jar Sample

DATE DRILLED: 5/5/99
EQUIPMENT USED: Hollow Stem Auger
GROUNDWATER LEVEL: Not Encountered

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LOG OF BORING #10

Appendix B

TABLE I
MAXIMUM DENSITY TESTS
(ASTM: D-1557-91)

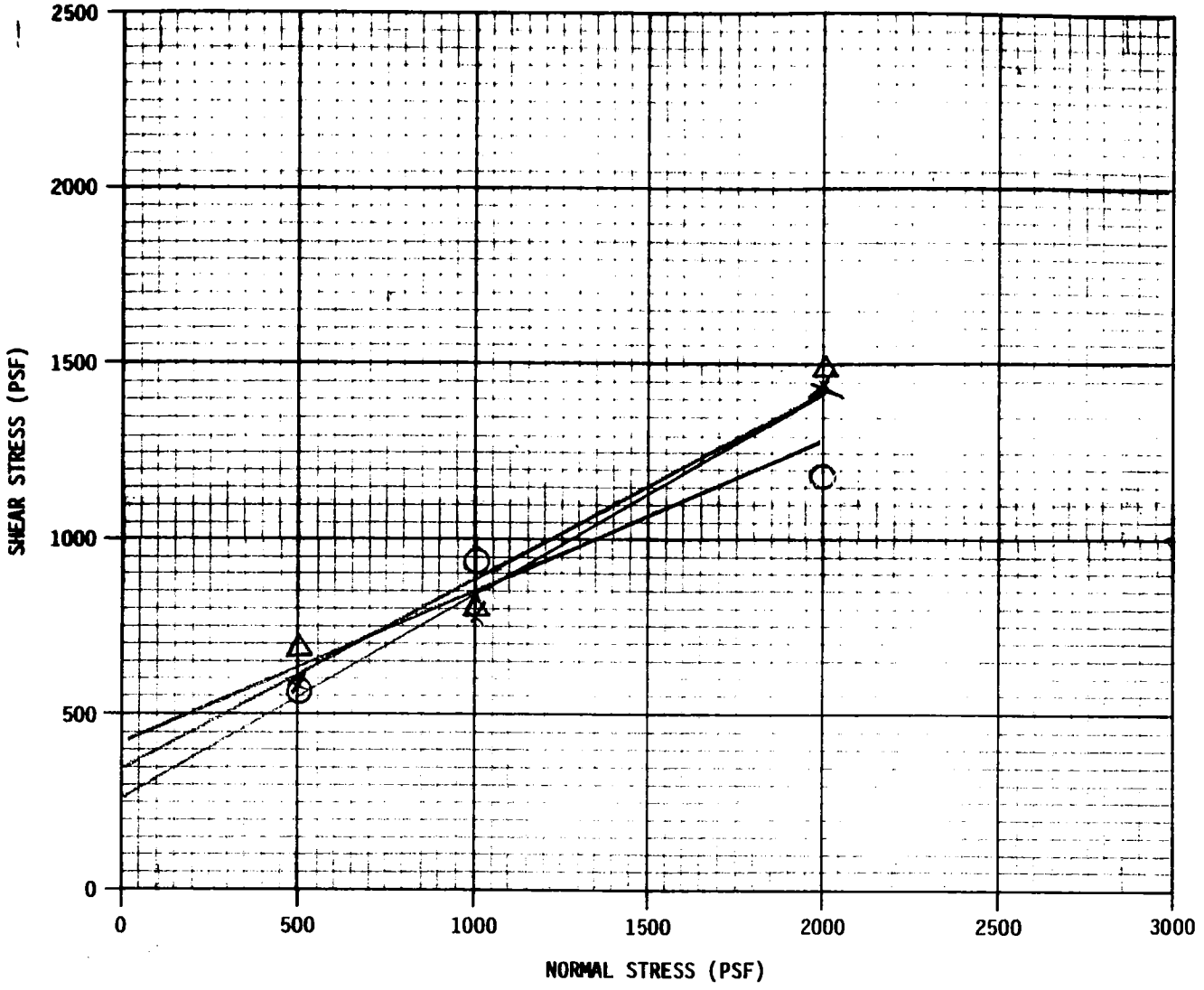
Sample	Classification	Optimum Moisture	Maximum Dry Density (lbs./cu.ft.)
TE1 @ 0-3'	Silty CLAY with SAND	14.0	119.0
TE1 @ 3-6'	Sandy CLAY	13.0	121.0
B9 @ 0-2'	Sandy CLAY with gravel	12.5	123.5

TABLE II
EXPANSION INDEX TESTS
(U.B.C. STD. 29-2)

Soil Type	Classification	Expansion Index
TE1 @ 0-3'	Silty CLAY with SAND	81
TE1 @ 3-6'	Sandy CLAY	73

TABLE III
SULFATE TESTS
(EPA 9038)

Sample	pH	Electrical Resistivity (uohms/cm)	Sulfate (%)



SYMBOL	BORING NUMBER	DEPTH (FEET)	ø (DEGREES)	C (PSF)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)
X	TE 2	2.5	30	275	116.9	11.8
O	B4	3.5	23	425	114.0	13.0
△	B7	3.0	28	350	115.1	13.7
□						

NOTE: TESTS PERFORMED ON SATURATED SAMPLES UNLESS SHOWN BELOW.
(FM) FIELD MOISTURE
TESTS PERFORMED ON UNDISTURBED SAMPLES UNLESS SHOWN BELOW.
(R) SAMPLES REMOLDED AT 90% OF MAXIMUM DRY DENSITY

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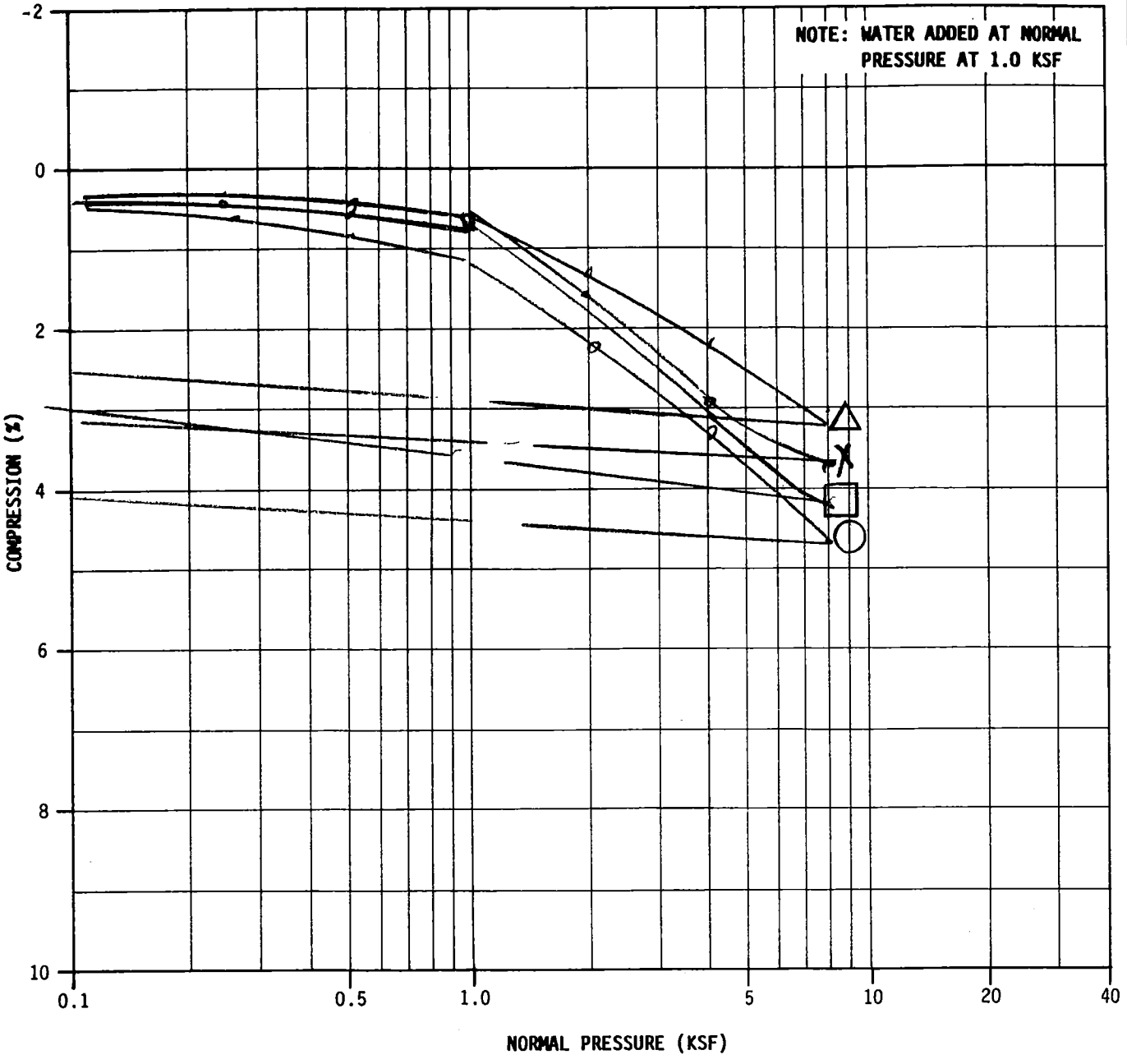
DIRECT SHEAR TEST RESULTS

PLATE A



SYMBOL	BORING NUMBER	DEPTH (FEET)	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)
X	TE 2	7.5	115.6	13.7		
O	TE 3	5.0	113.9	14.1		
△	B5	4.5	115.9	12.9		
□	B7	10	115.2	11.8		

——— COMPRESSION (FM) FIELD MOISTURE - NO WATER ADDED

– – – – REBOUND (R) SAMPLE REMOLDED AT 90% OF MAXIMUM DRY DENSITY

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CONSOLIDATION TEST RESULTS

PLATE B